
SUSTAINABLE ROAD NETWORKS DEVELOPMENT

by

Dr. A. Hermanto Dardak
Chairman of Indonesia Road Development (IRDA)
Director General of Highways, Ministry of Public Works,
The Republic of Indonesia

1. SUSTAINABLE DEVELOPMENT

The definition of sustainable development has been a grand topic of discussion in the last decades. The idea of sustainability dates back more than 35 years, to the new mandate adopted by IUCN in 1969¹. The concept was coined explicitly to suggest that it was possible to achieve economic growth and industrialization without environmental damage. In the ensuing decades, mainstream sustainable development thinking was progressively developed through the World Conservation Strategy (1980), the Brundtland Report (1987), and the United Nations Conference on Environment and Development in Rio (1992), as well as in national government planning and wider engagement from business leaders and non-governmental organizations of all kinds.

The Brundtland Report defined sustainable as ‘development that meets the needs of present without compromising the ability of future generations to meet their own needs². The two fundamental issues which captured by the Report are the problem of the environmental degradation that so commonly accompanies economic growth, and yet the need for such growth to alleviate poverty. Thus, the idea of sustainability stands on three dimensions of environmental, social and economic sustainability. This is often illustrated in the three Pillars of Sustainable Development.

¹ The new IUCN mandate in 1968 spoke of ‘the perpetuation and enhancement of the living world – man’s natural environment – and the natural resources on which all living things depend’, which referred to management of ‘air, water, soils, minerals and living species including man, so as to achieve the highest sustainable quality of life’

² B. Brundtland, H. *Our Common Future*, (Oxford: Oxford University Press, for the World Commission on Environment and Development, 1987)

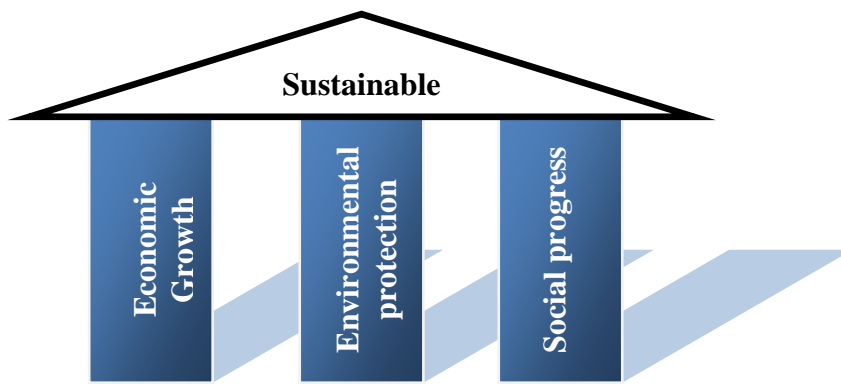


Figure 1. The Three Pillars of Sustainable Development.

The conventional understanding of sustainable development implies that trade-offs can always be made between environmental, social and economic dimensions of sustainability. This has been a topic of debate among experts. In response to this, a distinction is often drawn between 'strong' sustainability (where such trade-offs are not allowed or are restricted) and 'weak' sustainability (where they are permissible). The concept of 'critical natural capital' is also used to describe elements of the biosphere that cannot be traded off (e.g. critical ecosystems or species). However, in practice, development decisions by governments, businesses and other actors do allow trade-offs and put greatest emphasis on the economy above other dimensions of sustainability. This is a major reason why the environment continues to be degraded and development does not achieve desirable equity goals.

2. DEVELOPMENT IN INDONESIA

Indonesian archipelago consists of more than 13,500 islands. With 5 major islands, Java, Sumatera, Kalimantan, Sulawesi and Papua, and more than 1,8 million sq km of land area, land transportation plays a major role in region's development.

Indonesia had the luxury of rapid economical growth back in several last decades. During Suharto's presidency, economic growth was propelled to the highest level. Infrastructure development became the locomotive for industry growth. With economy rising, GNP was raised, as well as income per capita. There was a backside of this rapid economic growth. Environment degradation caused by more carbon released by industry to atmosphere, deforestation, forest fire, converting of peat moss to farm land, etc. Empirical study, comparisons between economic growths to the adverse environmental impact had shown that the second out weights the first.

As the global awareness increase, the pressure for reducing carbon emission and preservation of rain forest is increasing as well. The impact of these internal and external challenges to Indonesia gives a way to a more environmental friendly development. Indonesian is committed to put sustainable development as a platform of nation's development³. Since 1982, environment dimension has been given a

³ National Law No. 4 Year 1982, *Main Principles of Environmental Management*, and renewed by the National Law No. 23 Year 1997, *Environmental Management* states that the purpose of environmental management, to create an environmentally-sound sustainable development.

higher priority as a consideration in deciding the development of projects. But still, there have been so many cases in which the infrastructure development causes major damages to local environment.

2.1 ROAD DEVELOPMENT

As road ecosystems are rapidly becoming the most familiar land-use type in Indonesia, it is generally recognized that they will continue to remain an essential component of Indonesian day-to-day living.

With various geographic condition of Indonesia, road ecosystems can extend for thousands of kilometers across several landscape types and regions. Road ecosystems are primarily built for socio-economic purposes, to facilitate commerce, including human economic service, and secondarily to provide access to landscapes for multiple values and leisure activities (Brown 2003). Examples of road ecosystems include: major arterial roads such as freeways, highways, and motorways; regional or local roads; forest roads; agricultural roads, and utility roads.

As the major transport infrastructures in Indonesia, road network developments are bound to provide efficient and safe movement amongst regions and thus shape the national land use structure. The development aims to open and improve the accessibility of regions, either by providing new networks or improve the existing networks. The vast areas and the unequally dispersion of population density, diversity of social and natural characteristic and economical capability of regions have provided challenges for the Government of Indonesia in adapting the concept of the sustainable development. How can the road development answer the need of sustainable development?

Road networks development in Indonesia face many complex issues. Government still plays the major role in providing road infrastructure in Indonesia⁴. Department of Public Works (DPW) as the responsible agency had only limited budget to serve nation's need of public road. From more than of 390,000 km length of total road in Indonesia only 216,714 km was paved ⁵. Unequally dispersion of population causes the unequally development of road. Four major arterial networks were built along the east-west and south-north corridor of Java, Sumatera, Kalimantan, and Sulawesi. These are where the population growth is higher than the rest of the islands.

Road

Complexity of road is worsened by the false utilization of road, such as on street market, people doing activities on road and public transportation use road as terminal. People's understanding on road utilization is still far from

⁴ Business News, 7788/23-3-2009

⁵ National Statistical Bureau, 2005

what is expected. This is the result of false land utilization which doesn't meet the spatial planning in the region.

Inconsistency to the spatial planning is reflected through the regional development. Instead of the benefit gained, unplanned development contributed more burdens to the road itself. The shopping mall, market or social facilities buildings should be served by the secondary collector road, utilized commuter transportation system. Worsened by the unavailability of spatial transportation infrastructures, the national networks bear more burdens which were not supposed to be sustained.

Disoriented of spatial planning can be seen by the use of spatial drainage to road drainage. Because of water run-out more than the capacity, the road is flooded. Added by the extreme natural occurrences such as heavy rain, the road service age will be lessened.

2.2 SPATIAL PLANNING

Implementation of spatial planning and road networks development, in reality, can't be separated from the reality of unequally population dispersion, broad area and diversity of topographical condition. From current data, the population in Indonesia is widely dispersed. Java island (7,2 percent of total land area) is populated by more than 58,6 percent of total population, whereas Kalimantan, Sulawesi and Maluku islands (total 68,1 percent of total land area) are populated by 14,9 percent of total population⁶.

More than 70 percent of national road networks were built in Sumatera, Java and Bali islands, whereas the total land area is less than 32 percent of total nations land area. Twenty three percent serve Kalimantan, Sulawesi and NTB, represent 44 percent of total land area. The rest serve NTT, Maluku and Papua in which represent more than 25 percent of total land area.

⁶ National Statistical Bureau, 2004

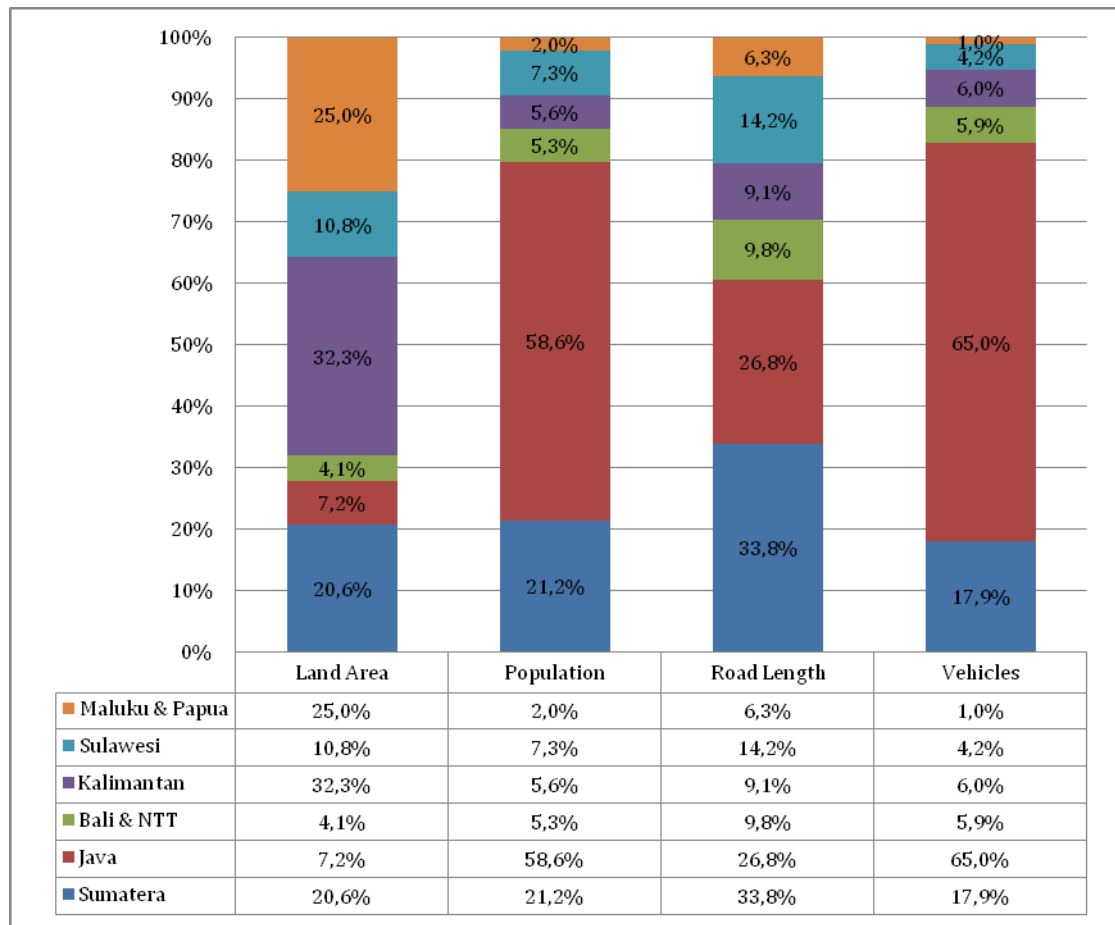


Figure 2. Comparison of Land Area, Population, Road Length, and Number of Vehicles

To face with the condition, road network development needs to be based on National Spatial Planning. The development of road networks must be implemented according to the regional development scenario within the spatial planning. The Laws on Road state that road development must be based on ruling spatial planning. This is meant for synchronization between road development and other transportation mode: sea, air, or train.

The concordance between different sectors serviced by road, such as commerce, industry and farming, is in utmost importance. The road development is an integral part of regions' and stakeholders' interest so that the road can make a solid network functioned as it was intended to be, not partially, and the process can involve all elements of society: government, private, and community.

3. SPATIAL BASIS ROAD NETWORKS DEVELOPMENT

National Spatial Planning (RTRWN) is established as the national strategic planning, which describes the direction and policy of national development in spatial manners. Road networks development is amongst the sector regulated by the RTRWN. Provincial Spatial Planning (RTRWP) elaborate RTRWN into a more detail plan,

including the provincial road networks planning. City/ District Spatial Planning elaborate RTRWP into a more detail plan, including the city and district road networks planning. Later on it will be detailed into the zoning and areal development in a more elaborate and measureable manners (see Fig.3).

To make it operational, City/ District Spatial Planning needs to be detailed into Detail Spatial Planning (RDTR) or Zone Planning which can be used as a base in issuing building permit and land use control. Program indicators composed in the RTRW/ RDTR use as basis to formulate Sector Master Plan. It is a derived demand from the consequences of zonal and land utilization. Road development in essence should be aimed to shape the land structure in accordance with the plan and the direction of regional development. In this case, road development considers region's condition in resources and strategic environment condition as an element of land use shape.

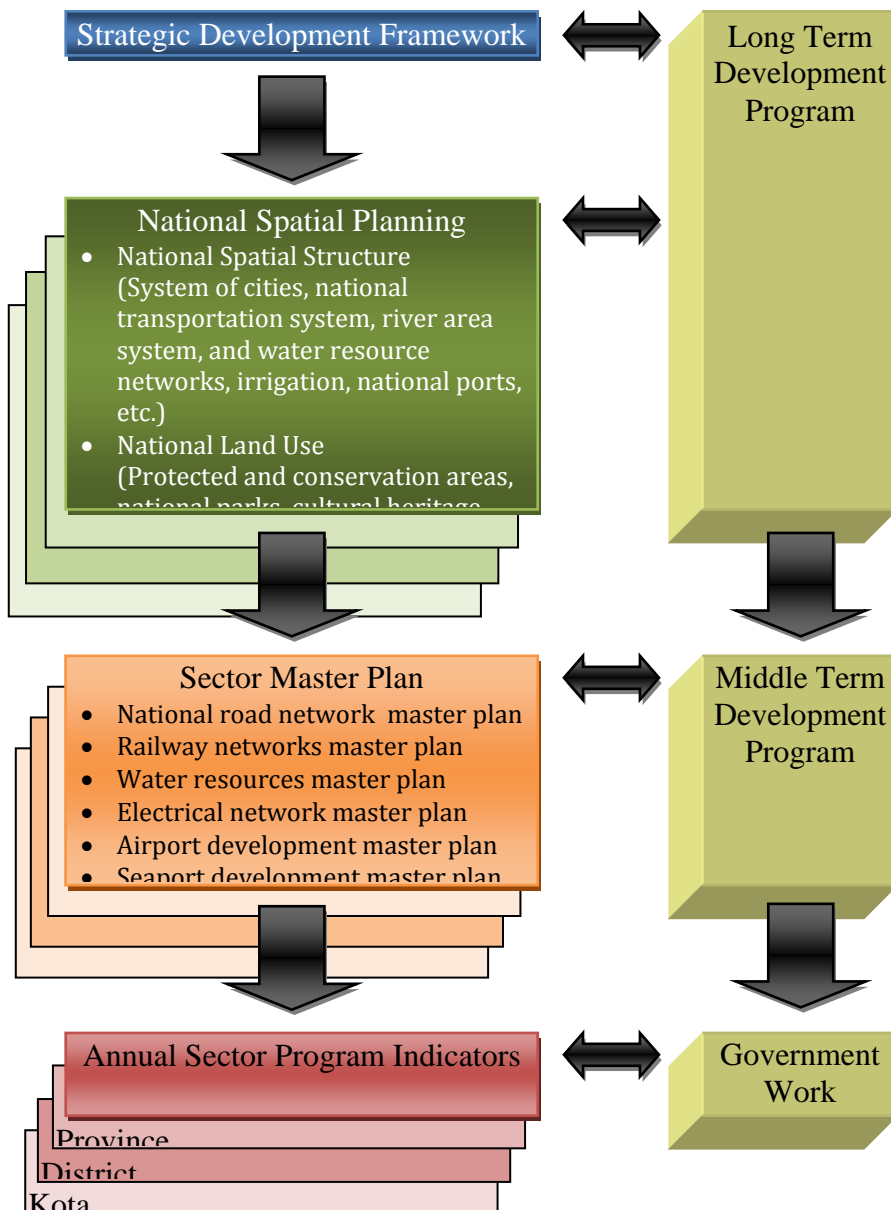


Figure 3. Hierarchy of Spatial Planning in Indonesia

Road infrastructure is a social asset for community. It implies that road plays an essence role as an asset to fulfill economic and social demand. Besides, road has a vital role to sustain economic advantages by connecting production resource and consumers. Socially, road is part of public space, used as interaction place between groups of community as manifestation of socio-cultural bonding. In broader context, road networks bind and unite Republic of Indonesia as one sovereign political entity. In land use context, road network is an important land use shape. Road's function must be maintained as planned. National roads (primary arterial road), as National land use shape, must be free from road side activities as consequences of false land utilization such as traditional markets and schools. The same thing should be applied to provincial or city roads. Land utilization must consistently comply to land use planning. Interaction between road networks as spatial structure, and land utilization as pattern of land use can be well organized and harmonious.

4. SUSTAINABLE ROAD DEVELOPMENT

In the context of sustainable development, road development must concern for three main aspects: economic, social and environment, because road network is part of land use interaction and transportation system (Fig. 4). Road existence must not contribute a negative impact to surrounding community and environment.

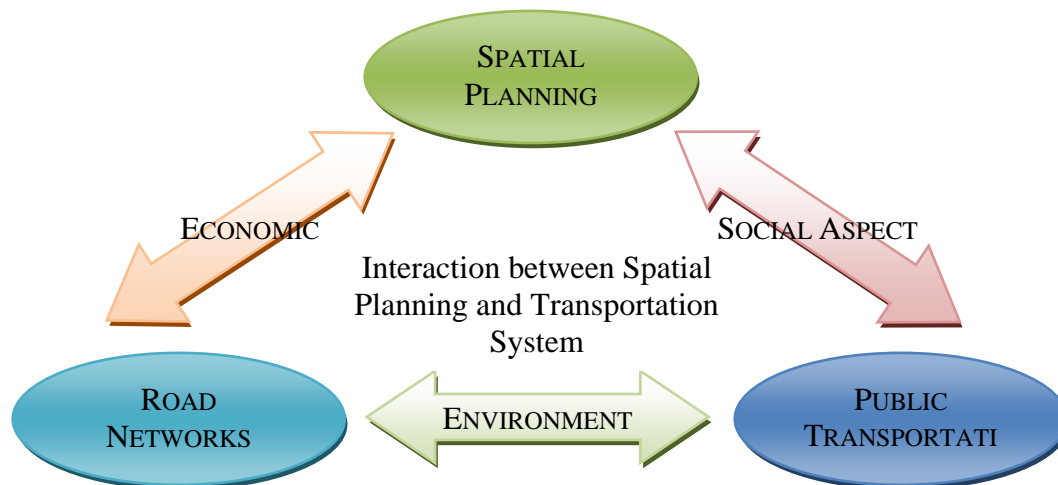


Figure 4. Interaction between Spatial Planning and Transportation System

Infrastructure's role in moving economic wheel is very important, whereas, every 1% of economic growth will cause 1.5% of traffic growth. Anticipation is needed by provision of physical improvement or transport demand management (TDM). Road network development in creating business opportunity and employment is potential to make multiplier effect to regional local economy. For example Cipularang tollroad development of 58 km, cost Rp. 1,6 triliun dan 100% local workers, employ 50.000 workforce, consume 500 thousands tons of cement, 25 thousands tons of mortar, 1,5 millions cubic of crush stone, and 500 thousands cubic of sand.

Empirical speaking, road development can raise the land value to ten times in the first year. In the short term, road development benefit the economy of the region. Traffic volume will also increasing coping with the development of new road⁷.

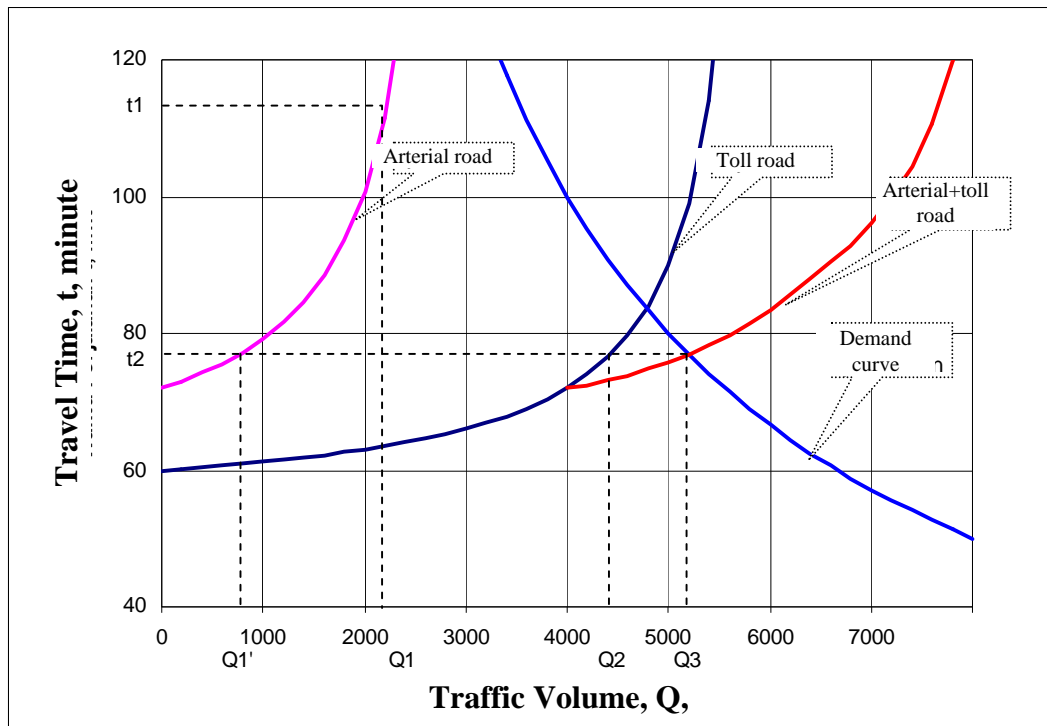


Figure 5. Supply-Demand Curve of Toll and Non Toll.

Traffic volume increase because of the decreasing of travel time from t_1 to t_2 as much as Q_3 so that the volume of generated traffic is $Q_3 - Q_1$.

In reality, traffic growth in several toll roads in Indonesia, for example Jagorawi, Cikampek, Semarang, Surabaya and other toll roads show a high growth from early years of road operation. Meanwhile during the next years, traffic growth is back to normal. Figure 6 and 7 show a high traffic growth in Jagorawi, Padaleunyi and Cikampek in early years, vary from 30% to 50%.

Meanwhile during the next years, traffic growth returned to 5%-6% annually. Toll roads in Indonesia creates traffic generation because of the improvement of accessibility. This can indicate a good economic indicator as the distribution line of crop product, industry and service is improving.

⁷ Wardrop, 1952, describe the relation between road infrastructure as supply line and traffic volume as demand line, in road development both toll road and arterial road network.

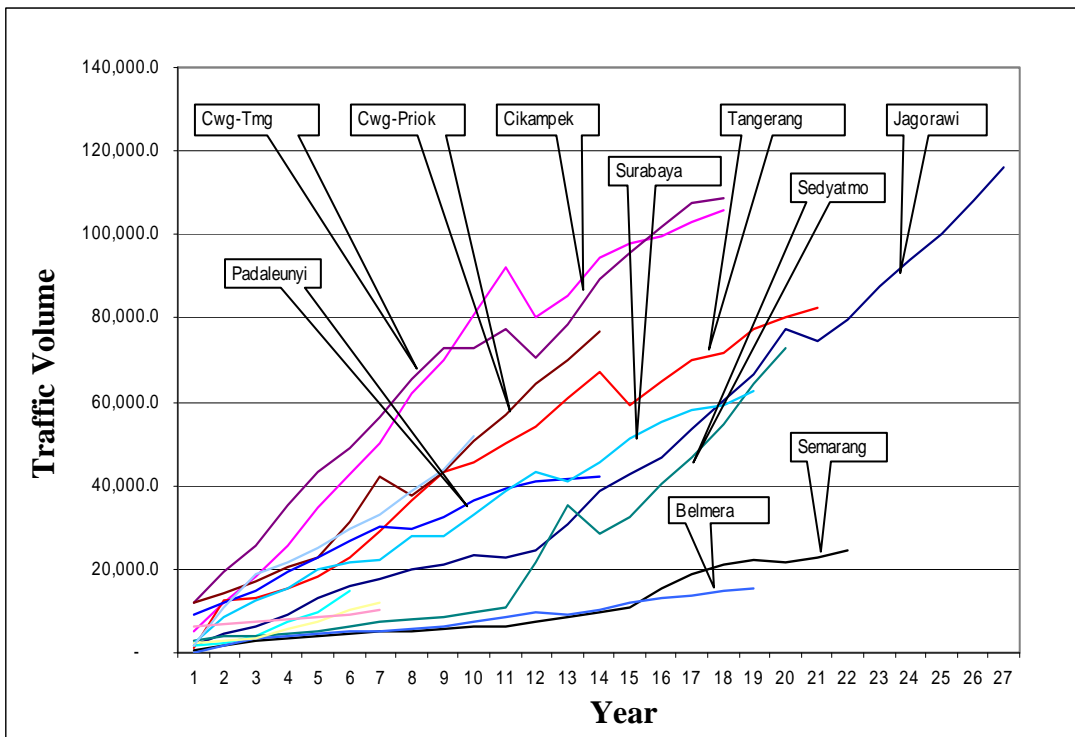


Figure 6. Traffic Growth of Toll Roads in Indonesia

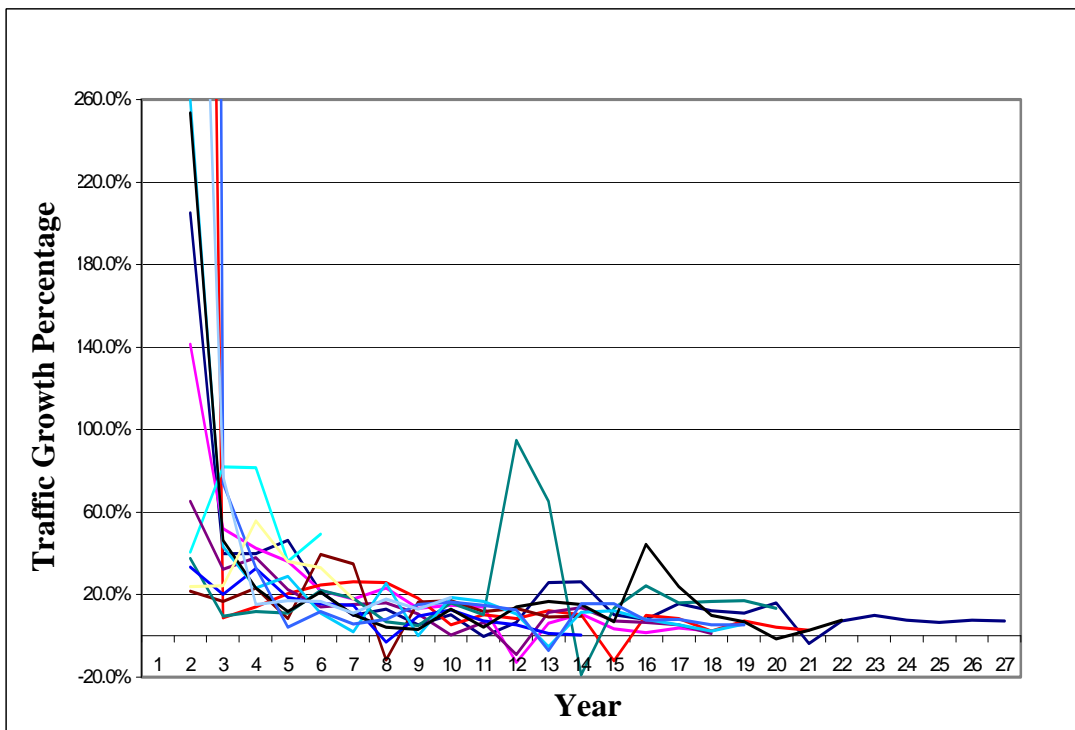


Figure 7. Level of Traffic Growth of Toll Roads in Indonesia.

Spatial planning policy can't be separated by the road infrastructure development policy. Spatial planning documents are the foundation of how a region shall be developed. Also of which region can be developed and which can't. Area with more than 30 percent slope is not suitable for settlement. But if the area is developed into a settlement, the road infrastructure must be provided, even with the risk of the landslide. In some cases, the road can be very steep.

Road infrastructure plays the role of catalyst to regional development. For example, Jakarta city is planned to expand east-west. Road must be developed towards east and west area of Jakarta to stimulate economic activities in those areas.

5. SUMMARY

To accommodate economic services, road ecosystems must continue to remain efficient and competitive which generally demands larger and faster roads such as highways and motorways, while socially, transportation systems are required for day-to-living to reach employment centers, shopping centers, schools and recreational facilities. For these reasons roads must remain safe and accessible. In addition, transportation systems need to respect the natural environment including the landscape, its ecosystems and habitats. Sustainable road ecosystem development is therefore concerned with integrating economic, social and environmental considerations into decisions regarding human mobility.

Road network development must be done in harmony with other sectors and unites regions as part of national regional development. The development will sustain a strategic national platform, where the existing road network will not only function to increase accessibility, but also play a role in regional development.

Economically, road networks can increase distribution line effectively. In development process, road can create employment and propel construction industries and services. Nevertheless, spatially speaking, impact of road development must be anticipated, to produce a proper balance to environment, and social aspects. With the spatial basis road development, a productive, comfort and sustainable National development can be acquired.